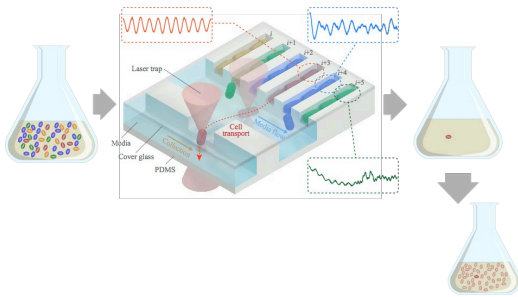


M.Sc. / Ph.D. student position will be available, starting in the Fall 2021 / Winter 2022 in the group of Professor Laurent Potvin-Trottier at the Department of Physics, Concordia University, Montreal, Canada.



The Potvin lab is located in the Center for Applied Synthetic Biology, the first and only synthetic biology center in Canada. The highly interdisciplinary and collaborative center is composed of groups of biologists, physicists, biochemists, and engineers, among others, and has state of the art facility, such as the recently inaugurated Genome Foundry. The Genome Foundry is equipped with automatized robotic instruments to facilitate the high-throughput assembly of genomes.

High-throughput screening of single-cell dynamics using microfluidics and optical tweezers

Synthetic biology, by engineering biological systems for specific functions, can have widespread applications. For example, microorganisms can be engineered to produce valuable chemicals that are difficult to synthesize. Moreover, building simple circuits with well-characterized molecular components can teach us a lot about biology. These minimal circuits provide us with a tractable context where we can control all of the components and their interactions (much like a biological electronic breadboard). The lab research goals are to engineer reliable synthetic gene circuits suitable for impactful applications, and to use them as models and tools to learn more about biology, in addition to generating useful perturbations to probe biological systems. Using approaches inspired by physics, these minimalistic models can give us deeper insights into biological systems.

Previously, we have succeeded in engineering the most precise and robust synthetic oscillator to date. This was done with multiple iterations of precise evaluation of the circuit's properties in a microfluidic device, stochastic modeling of the circuit followed by re-design, to end up with a handful of circuits. Now, we propose to engineer thousands of circuits simultaneously to learn about the fundamental limits of biological systems. The project will consist evaluating precisely the dynamic properties, such as oscillations, of thousands of single cells, using quantitative time-lapse microscopy and microfluidics to keep the growth conditions perfectly uniform. Quantitative analysis using automated image segmentation and computational analysis will enable finding the cells with interesting properties. Then, the cells carrying these synthetic circuits will be moved in a separate collection channel using optical tweezers with high powered infrared laser for isolation and further analysis. The project will integrate well with others in the lab, such as the design of precise, robust, and low burden synthetic oscillators.

Concordia Department of Physics is a growing department in a university with rapidly increasing rating. We offer research-based M.Sc. and Ph.D. programs. Our faculty members conduct research in the areas of Condensed Matter Physics (theoretical and experimental), Molecular Biophysics, Medical Physics / Imaging, Photonics, Theoretical High Energy Physics, Computational Physics and Physics Education.

Successful applicants will be offered financial packages consisting of RA, TA and various awards of at least 20,000 CAD per year (often more), for 4 years (Ph.D.) or 2 years (M.Sc.). International students will be offered tuition remissions or other awards to compensate for the international tuition fees.

Please contact Professor Laurent Potvin-Trottier (Laurent.potvin@concordia.ca) or Professor Valter Zazubovits, Graduate Program Director (valter.zazubovits@concordia.ca) for more information.